

**CHARLES BOLDEN, NASA ADMINISTRATOR**  
**7<sup>th</sup> WERNHER VON BRAUN MEMORIAL SYMPOSIUM**  
**“MOVING FORWARD IN EXPLORATION”**  
**HUNTSVILLE, ALABAMA**  
**OCTOBER 28, 2014**

Hello Rocket City! I always look forward to coming to Huntsville where so much of NASA history has been made and so much more is being made today. We have not seen such a flurry of activity at Marshall Space Flight Center since Wernher von Braun led the development of the Saturn V rocket that made possible the first steps on the moon by Neil Armstrong and Buzz Aldrin. Huntsville, America’s “Rocket City”, is once again at the forefront of America reaching higher – developing the Space Launch System (SLS), the heavy lift rocket that will allow NASA to take its next giant leap in human exploration on the journey to Mars.

This is an especially exciting time to be here. As NASA and Marshall continue to make progress on this journey to Mars, many of the technologies needed to complete that journey are being developed right here in Huntsville. Just yesterday, at the Davidson Center for Space Exploration, Marshall held its annual Technology Exposition, where the top technologists at Marshall and throughout NASA got a chance to talk with leaders in business and academia about the roles they might play as we develop exciting new technologies that will enable both humans and our spacecraft to thrive in deep space.

As we speak, a lot of those technologies are being developed and tested aboard the International Space Station. Each day, around the clock, the Marshall Payload Operations Center team here in Huntsville helps our on-orbit astronauts conduct groundbreaking science from the Station.

Marshall and our commercial partner, Made in Space, recently developed the first 3D printer launched and delivered to

the Space Station. It arrived on September 23<sup>rd</sup> as part of a SpaceX Dragon spacecraft cargo payload.

Yesterday, as part of Marshall's Technology Expo, we held a public forum called Destination Station where we engaged the audience in a conversation about the vital role the International Space Station is playing in exploration technology development.

So these are exciting times in Huntsville, at Marshall and throughout NASA.

Today I want to talk with you about NASA's most exciting adventure since the days of Von Braun and the Apollo moon landings – the progress we are making towards realizing a dream that has eluded humankind for centuries – a human journey to Mars.

While humans have been fascinated with Mars since the beginning of time, there are a number of very tangible reasons why we need to learn more about our closest planetary neighbor.

For one thing, Mars' formation and evolution are comparable to Earth's and we know that at one time Mars had conditions suitable for life.

What we learn about the Red Planet may tell us more about our own home planet's history and future and help us answer a fundamental human question – does life exist beyond Earth?

While NASA has been on a path to Mars for decades with our earlier Mars rovers and orbiters, a critical national policy statement in support of our strategy was made on April 15, 2010 during a visit by President Obama to Kennedy Space Center when he challenged the nation to send humans to an asteroid by 2025 and to Mars in the 2030s.

The U.S. National Space Policy, released in June 2010, further supports those goals and over the past several years NASA has been developing the capabilities to meet these goals through a bipartisan space exploration plan agreed to by the Administration and Congress and embraced by the international

space community in the 2013 *Global Exploration Roadmap* (GER).

While America has led the robotic exploration of Mars for more than 40 years, NASA's journey for the human exploration of Mars begins in low-Earth orbit aboard the International Space Station, our springboard to deep space. As I mentioned earlier, as we speak, astronauts aboard the ISS are helping us learn how to safely execute extended missions deeper into space.

The key to the success of ISS has been the cooperation between NASA and our international partners.

In a world rife with geopolitical conflict and uncertainty, this unique orbiting laboratory is a clear demonstration of the benefits to humankind that can be achieved through peaceful global cooperation. We are guaranteed this unique international treasure for at least another decade by the Obama Administration's commitment to extend the ISS until at least 2024.

This means an expanded market for private space companies, more groundbreaking research and science discovery in micro-gravity and opportunities to live, work and learn in space over longer periods of time.

As most of you know, NASA has already returned space station resupply launches to American soil – and will soon do the same for human spaceflight launches.

Already, two American companies – SpaceX and Orbital Sciences – are making regular cargo deliveries to the Space Station.

Last month, we selected two American companies, Boeing and SpaceX, to complete the NASA certification for human space transportation systems capable of carrying people into orbit and ending our sole reliance on Russia. Once certification is complete, NASA plans to use these new systems to ferry astronauts to the International Space Station and return them

safely to Earth. If the Congress fully funds our FY 2015 budget request, we believe we can do this by the end of 2017.

In parallel, we are working on our next step, deep space, where NASA will send the first mission to capture and redirect an asteroid to orbit the moon.

Astronauts aboard the *Orion* spacecraft will explore the asteroid in the 2020s, returning to Earth with samples. This experience in human spaceflight beyond low-Earth orbit will help NASA test new systems and capabilities – such as advanced Solar Electric Propulsion (SEP) – we'll need to support a human mission to Mars.

Beginning in 2018, NASA's powerful Space Launch System (SLS) rocket will enable these “proving ground” missions to test new capabilities. On September 12, I had the opportunity to join many of you at a ribbon cutting at NASA's Michoud Assembly Facility in New Orleans (which is managed by Marshall) for the

new 170 foot high Vertical Assembly Center, the state of the art tooling facility that will weld together the massive core stage of the SLS.

Human missions to Mars will rely on *Orion* and an evolved version of SLS that will be the most powerful launch vehicle ever flown. The Space Launch System rocket is essential to NASA's deep space exploration endeavors. SLS delivers more capacity and thrust than any past, present, or otherwise planned vehicle. With the production of an extremely powerful rocket, like the Space Launch System, humans can more readily explore deep space, sending astronauts where we've never been before.

A fleet of robotic spacecraft from several nations and NASA rovers with significant international involvement already are on and around Mars, dramatically increasing our knowledge about the Red Planet and paving the way for future human explorers.

The Mars Science Laboratory *Curiosity* rover measured radiation on the way to Mars and is now sending back radiation

data from the Martian surface. This data will help us plan how to protect the astronauts who will explore Mars. A month ago, after a nine-month journey, NASA's *MAVEN* orbiter entered orbit around Mars. As the first orbiter dedicated to studying Mars' upper atmosphere, *MAVEN* will greatly improve our understanding of the history of the Martian atmosphere, how the climate has changed over time, and how that has influenced the evolution of the surface and the potential habitability of the planet. It also will better inform a future mission to send humans to the Red Planet in the 2030s.

Future NASA missions like the Mars 2020 rover, seeking the signs of past life, also will demonstrate new technologies that could help astronauts survive on Mars.

Engineers and scientists in the United States and around the world are working hard to develop the technologies astronauts will use to one day live and work on Mars and safely return home.

It is important to remember that NASA sent humans to the moon by setting a goal that seemed beyond our reach. I accept the criticism some continually express that NASA and this Administration are over reaching with Mars as our next human exploration goal. But since this is the von Braun Symposium, I am compelled to recall that it was the namesake for this forum, Wernher von Braun, who reminded us, “Mankind’s reach should always exceed his grasp.”

With Mars as our focus, we are steadily building the capability to enable human missions to the Red Planet.

The challenge is huge, but we are making real progress today as a radiation monitor on the *Curiosity* rover records the Martian radiation environment that our crews will experience; advanced entry, descent and landing technologies needed for landing on Mars were tested high above the waters of the Pacific Ocean in June; and *Orion* is finishing preparation for its first test flight December. This uncrewed mission will see *Orion* travel

farther into space than any human spacecraft has gone in more than 40 years.

Finally, I think we can all agree that beyond the scientific and economic benefits of launching into space – of literally leaving this planet – there is something intrinsically unifying about humankind's exploration of the heavens. As one who has flown into space four times, I can tell you that when viewed from orbit, our borderless Earth inspires a sense of humility, unity of humanity and wonder.

As the great British astronomer Sir Fred Hoyle said in 1948, "Once a photograph of the Earth, taken from outside, is available, a new idea as powerful as any in history will be let loose." How true was his vision!

I firmly believe that the original picture of our "blue planet" from the vantage point of the Apollo 8 crew, returning to Earth from their trip around the moon on that Christmas Eve so many

years ago now, forever changed humanity's perspective on our planet.

The partnerships we have forged with all of you are giving more people around the world the opportunity to experience the wonder and exhilaration of spaceflight – to realize the dream of leaving Earth for even a short time to float above our planet, Earth, in microgravity and to see the stars and the majestic tapestry of the Milky Way unobstructed by the artificial lights and dust of our atmosphere.

These citizen space travelers will also help us imagine and realize new benefits that can be brought back to Earth.

The future of space exploration is bright, but our journey is not for the timid or faint of heart. If you're looking for something that will receive overwhelming public support and breeze through future Administrations and Congresses, you're in the wrong business! It will be up to all of us in this assembly to continue working together, pushing the bounds of technological possibility,

and telling our story of hope for humanity that we see on this great adventure. If we do, I am confident we will continue to improve life on Earth and transform our shared vision of space exploration into a shared reality of unlimited discovery.

Thank you.